echinostome metacercariae may not be sufficient for precise identification solely on the basis of morphology.

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Literature Cited

Anderson, J. W., and B. Fried. 1987. Experimental infection of *Physa heterostropha, Helisoma trivolvis,* and *Biomphalaria glabrata* (Gastropoda) with *Echinostoma revolutum* (Trematoda) cercariae. Journal of Parasitology 73:49–54.

Beaver, P. C. 1937. Experimental studies on *Echinostoma revolutum* (Froelich), a fluke from birds and mammals. Illinois Biological Monographs 15: 1–96.

Christensen, N. Ø., A. B. Odaibo, and P. E. Simonsen. 1988. *Echinostoma* population regulation in experimental rodent definitive hosts. Parasitology Research 75:83–87.

Fried, B., and S. Emili. 1988. Excystation in vitro of *Echinostoma liei* and *E. revolutum* (Trematoda) metacercariae. Journal of Parasitology 74:98–102.

Irwin, S. W. B., G. McKerr, B. C. Judge, and I. Moran. 1984. Studies on metacercarial excystment in *Himasthla leptosoma* (Trematoda: Echinostomatidae) and newly emerged metacercariae. International Journal for Parasitology 14:415–421.

Jeyarasasingam, U., D. Heyneman, H.-K. Lim, and N. Mansour. 1972. Life cycle of a new echinostome from Egypt, *Echinostoma liei* sp. nov. (Trematoda: Echinostomatidae). Parasitology 65:203–222.

Kanev, I. 1985. On the morphology, biology, ecology and taxonomy of *E. revolutum* group (Trematoda: Echinostomatidae: *Echinostoma*). Doctoral Dissertation, Sofia University, Sofia, Bulgaria. (In Bulgarian.)

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Research Note

Helminths of the Arizona Little Striped Whiptail, *Cnemidophorus inornatus arizonae*, and the Desert Grassland Whiptail, *Cnemidophorus uniparens* (Sauria: Teiidae), from Southeastern Arizona

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ABSTRACT: Examination of the gastrointestinal tract of 78 *Cnemidophorus inornatus arizonae* Van Denburgh, 1896, revealed the presence of the nematodes, *Pharyngodon warneri* Harwood, 1932, and *Physaloptera* sp. Rudolphi, 1819, and a cestode, *Oochoristica bivitellobata* Loewen, 1940. Overall prevalence of infection was 33%. The highest prevalence and mean intensity was for *P. warneri,* 23% and 15.4, respectively. Examination of the gastrointestinal tract of 31 *Cnemidophorus uniparens* Wright and Lowe, 1965, revealed only the cestode *O. bivitellobata*; prevalence was 26% and mean intensity was 2.1. One juvenile acanthocephalan, *Acanthocephalus* sp. Koelreuther, 1771, was also found. Presence of *Physaloptera* sp., O. *bivitellobata,* and *Acanthocephalus* sp. are new host records.

KEY WORDS: Nematoda, Cestoda, Acanthocephala, prevalence, intensity, survey, Teiidae, *Cnemidophorus inornatus arizonae, Cnemidophorus uniparens.*

The Arizona little striped whiptail, *Cnemidophorus inornatus arizonae* Van Denburgh, 1896, occurs in arid and semiarid grasslands of western New Mexico and southeastern Arizona (Behler and King, 1979). The desert grassland whiptail, *Cnemidophorus uniparens* Wright and Lowe, 1965, occurs in desert scrub from central Arizona through southern New Mexico to El Paso, Texas, and south into Chihuahua, Mexico (Steb-

Table 1. Prevalence, location, and intensity of gastrointestinal helminths in 78 *Cnemidophorus inornatus* and 31 *C. uniparens*.

Parasite	*C. inornatus*		*C. uniparens*	
	Prevalence (%)	Mean intensity (range)	Prevalence (%)	Mean intensity (range)
Nematoda				
*Pharyngodon warneri**†	23	15.4 (1–73)	—	—
Physaloptera sp.‡	1	—	—	—
Cestoda				
*Oochoristica bivitellobata**	13	1.7 (1–4)	26	2.1 (1–8)
Acanthocephala				
Acanthocephalus sp.‡	—	—	3	—

* Small intestine.
† Large intestine.
‡ Stomach.

bins, 1985); only females are known (Wright and Lowe, 1965). The purpose of this note is to describe the prevalence and intensity of helminth infections in *C. i. arizonae* and *C. uniparens* from the Willcox Playa of southeastern Arizona. Specian and Ubelaker (1974a, b) have previously reported nematodes from the Trans-Pecos little striped whiptail, *Cnemidophorus inornatus heptagrammus* Axtell, 1961, from west Texas. To our knowledge, there are no reports on the endoparasites of *C. uniparens*.

A total of 109 adult lizards collected by the senior author was examined. Seventy-eight *C. i. arizonae* (37 male, 41 female) were collected in May–August 1966 and May 1967, from the southern edge of Willcox (32°14′N, 109°50′W; elevation 1,269 m), Cochise County, Arizona. Thirty-one female *C. uniparens* were collected in June–August 1966, 0.8 km from the junction of Arizona Highway 186 and Kansas Settlement Road on Arizona Highway 186 (32°11′N, 109°45′W; elevation 1,280 m), Cochise County, Arizona. Lizards were shot with 22-caliber dust shot and preserved in Bouin's fixative. They were later transferred to neutral buffered 10% formalin. This collection was recently rediscovered. The body cavity was opened by a longitudinal incision from vent to throat and the gastrointestinal tract was excised by cutting across the anterior esophagus and the rectum. Esophagus, stomach, small intestine, and large intestine were examined separately. Each organ was slit longitudinally and examined under a dissecting microscope. Each helminth was examined and identified utilizing a glycerol wet mount. For detailed microscopy, selected nematodes were stained with iodine and selected cestodes were stained with hematoxylin.

Of the 78 *C. i. arizonae* examined, 26 contained helminths, a prevalence of 33%. Prevalence, location, and mean intensity by species are presented in Table 1. *Pharyngodon warneri* Harwood, 1932, was the major intestinal parasite and was found in the posterior segment of the small intestine as well as the large intestine (18 infected lizards harbored 277 nematodes). *Oochoristica bivitellobata* Loewen, 1940, was recovered from the small intestine (10 infected lizards; 17 cestodes) and third-stage *Physaloptera* sp. Rudolphi, 1819 (1 lizard; 2 nematodes), was found in the stomach. Eight of the 31 *C. uniparens* (Table 1) contained a total of 17 *O. bivitellobata*, all from the small intestine. A juvenile acanthocephalan was found among the stomach contents of 1 *C. uniparens*. The juvenile acanthocephalan had 16 rows of hooks with 5–6 hooks per row typical of the genus *Acanthocephalus* Koelreuther, 1771 (see Petrochenko, 1971). The *C. uniparens* sample had a helminth prevalence of 29%. Representative specimens were deposited in the USNM Helminthological Collection,

Table 2. Monthly prevalences of *Pharyngodon warneri* in *Cnemidophorus inornatus arizonae*.

Month	Male		Female	
	N	% infected	*N*	% infected
1966 May	5	0	9	0
June	3	33	1	0
July	15	40	18	28
August	8	25	9	33
1967 May	6	0	4	25

Table 3. Monthly prevalences of *Oochoristica bivitellobata* in *Cnemidophorus inornatus arizonae* and *C. uniparens*.

	C. i. arizonae					
	Male		Female		*C. uniparens*	
Month	*N*	% infected	*N*	% infected	*N*	% infected
1966 May	5	0	9	11	—	—
June	3	0	1	0	8	0
July	15	13	18	22	20	35
August	8	0	9	22	3	33
1967 May	6	0	4	25	—	—

USDA, Beltsville, Maryland 20705: for *C. i. arizonae, Oochoristica bivitellobata* (80770); *Pharyngodon warneri* (80769); *Physaloptera* sp. (80768); *Acanthocephalus* sp. (80767); for *C. uniparens, Oochoristica bivitellobata* (80766).

Infection prevalence between male and female *C. i. arizonae* (Table 2) was evaluated by the Kruskal–Wallis test, a rank-order analysis (Eckblad, 1984). The infection prevalence between males and females was not significantly different (for *P. warneri*: $j = 0.01$, 1 df, $P > 0.05$; for *O. bivitellobata*: $j = 3.15$, 1 df, $P > 0.05$). Prevalence between *C. i. arizonae* and *C. uniparens* for *O. bivitellobata* (Table 3) was also evaluated by the Kruskal–Wallis test ($j = 0.8$, 1 df, $P > 0.05$); again, there was no significant difference.

Pharyngodon warneri has been previously reported from *C. inornatus* (Specian and Ubelaker, 1974a) as well as from *Cnemidophorus laredoensis* (McAllister et al., 1986), *Cnemidophorus sexlineatus* (Dyer, 1971), *Cnemidophorus tigris* (Grundmann, 1959; Babero and Matthias, 1967), and *Urosaurus ornatus* (Walker and Matthias, 1973). *Oochoristica bivitellobata* was originally described from *C. sexlineatus* (Loewen, 1940) and has been recovered from *C. tigris* (Grundmann, 1959; Babero and Matthias, 1967; Telford, 1970; Benes, 1985; Lyon, 1986), *Cnemidophorus hyperythrus* (Bostic, 1965), and *Cnemidophorus burti stictogrammus* (Goldberg and Bursey, 1989). See Baker (1987) for a list of *Physaloptera* species recorded from lizards.

Mitchell (1979) found a large overlap in the insectivorous diets of *C. i. arizonae* and *C. uniparens* from the Willcox Playa. Thus, it is not suprising that both species are infected by *O. bivitellobata* which, if it is like *Oochoristica anolis* Harwood, 1932, requires an insect intermediate host (Conn, 1985). Oxyurid nematode infections are acquired directly by egg ingestion (Olsen, 1974). Thus, some aspect of life history other than diet apparently controls *P. warneri* infection; its absence in *C. uniparens* deserves further study.

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Literature Cited

Babero, B. B., and D. V. Matthias. 1967. *Thubunaea cnemidophorus* n. sp., and other helminths from lizards, *Cnemidophorus tigris,* in Nevada and Arizona. Transactions of the American Microscopical Society 86:173–177.

Baker, M. R. 1987. Synopsis of the Nematoda parasitic in amphibians and reptiles. Memorial University of Newfoundland, Occasional Papers in Biology, No. 11. 325 pp.

Behler, J. L., and F. W. King. 1979. The Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, New York. 744 pp.

Benes, E. S. 1985. Helminth parasitism in some central Arizona lizards. Southwestern Naturalist 30: 467–473.

Bostic, D. L. 1965. Parasites of the teiid lizard, *Cnemidophorus hyperythrus beldingi.* Southwestern Naturalist 10:313.

Conn, D. B. 1985. Life cycle and postembryonic development of *Oochoristica anolis* (Cyclophyllidea: Linstowiidae). Journal of Parasitology 71:10–16.

Dyer, W. G. 1971. Some helminths of the six-lined lizard, *Cnemidophorus sexlineatus,* in South Dakota. Proceedings of the Helminthological Society of Washington 38:256.

Eckblad, J. 1984. Key-Stat: An Integrated Series of Statistical Programs. Oakleaf Systems, Decorah, Iowa. 10 pp.

Goldberg, S. R., and C. R. Bursey. 1989. Helminths of the giant spotted whiptail, *Cnemidophorus burti stictogrammus* (Sauria: Teiidae). Proceedings of the Helminthological Society of Washington 56: 86–87.

Grundmann, A. W. 1959. Parasites recovered from six species of Utah lizards. Journal of Parasitology 45:394.

Loewen, S. L. 1940. On some reptilian cestodes of the genus *Oochoristica* (Anoplocephalidae). Transactions of the American Microscopical Society 59:511–518.

Lyon, R. E. 1986. Helminth parasites of six lizard species from southern Idaho. Proceedings of the Helminthological Society of Washington 53:291–293.

McAllister, C. T., S. E. Trauth, and J. E. Ubelaker. 1986. Nematode parasites of the parthenogenetic whiptail lizard, *Cnemidophorus laredoensis* (Sauria: Teiidae) from south Texas. Proceedings of the Helminthological Society of Washington 53:138–139.

Mitchell, J. C. 1979. Ecology of southeastern Arizona whiptail lizards (*Cnemidophorus*: Teiidae): population densities, resource partitioning, and niche overlap. Canadian Journal of Zoology 57: 1487–1499.

Olsen, O. W. 1974. Animal Parasites: Their Life Cycles and Ecology. University Park Press, Baltimore, Maryland. 562 pp.

Petrochenko, V. I. 1971. Acanthocephala of Domestic and Wild Animals. Israel Program for Scientific Translations Ltd. 465 pp.

Specian, R. D., and J. E. Ubelaker. 1974a. Two new species of *Pharyngodon* Diesing, 1861 (Nematoda: Oxyuridae) from lizards in west Texas. Proceedings of the Helminthological Society of Washington 41:46–51.

———, **and** ———. 1974b. *Parathelandros texanus* n. sp. (Nematoda: Oxyuridae) from lizards in west Texas. Transactions of the American Microscopical Society 93:413–415.

Stebbins, R. C. 1985. A Field Guide to Western Reptiles and Amphibians. Houghton-Mifflin Company, Boston. 336 pp.

Telford, S. R. 1970. A comparative study of endoparasitism among some southern California lizard populations. American Midland Naturalist 83:516–554.

Walker, K. A., and D. V. Matthias. 1973. Helminths of some northern Arizona lizards. Proceedings of the Helminthological Society of Washington 40: 168–169.

Wright, J. W., and C. H. Lowe. 1965. The rediscovery of *Cnemidophorus arizonae* Van Denburgh. Journal of the Arizona Academy of Science 3:164–168.

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Research Note

Serological Prevalence of *Neospora caninum* and *Toxoplasma gondii* in Dogs from Kansas

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ABSTRACT: Sera from 229 dogs were examined for antibodies to *Neospora caninum* using an indirect immunofluorescence assay and for antibodies to *Toxoplasma gondii* using a direct agglutination test. Five of the dogs (2%) were positive for antibodies to *N. caninum* and 57 (25%) were positive for antibodies to *T. gondii*. Three (1%) of the dogs had antibodies to both protozoans. Results indicate that *N. caninum* is less prevalent in the canine population than *T. gondii*.

KEY WORDS: *Neospora caninum, Toxoplasma gondii,* dog, prevalence.

Neospora caninum Dubey, Carpenter, Speer, Topper, and Uggla, 1988, is a recently described protozoan parasite of dogs (Dubey et al., 1988a, b). It is similar to *Toxoplasma gondii* Nicolle and Manceaux, 1909, with light microscopy but can be differentiated by using transmission electron microscopy (Dubey et al., 1988a; Speer and Dubey, 1989) or serological and immunohistochemical testing (Bjerkås and Presthus, 1988; Lindsay and Dubey, 1989b, c). Clinical neosporosis in dogs manifests itself as polymyositis, encephalitis, polyradiculoneuritis, and ascending paralysis (Cummings et al., 1988; Dubey et al., 1988a, b). The disease can be fatal in young or old dogs but is more serious in transplacentally infected puppies. Clinical toxoplasmosis in dogs is usually seen in young animals and is associated with concurrent distemper virus infection (reviewed by Dubey, 1985).

Nothing is known about the prevalence of *N. caninum* infection in the canine population, whereas *T. gondii* infection is common (Dubey, 1985). In the present study we examined sera from 229 dogs for antibodies to *N. caninum* and *T. gondii*.

All dogs were patients at the Veterinary Med-

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